THE ROLE OF COGNITIONS IN PAIN AND DEPRESSION

By

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TABLE OF CONTENTS

Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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The use of negative thoughts has been associated with lower pain tolerance, higher pain ratings and increased rates of depression among chronic pain patients. Fifty-eight adult chronic pain patients, recruited from the Facial Pain Center at the University of Florida, were asked to participate in a study investigating the role of cognitions in pain. Subjects completed the Beck Depression Inventory (BDI), Inventory of Negative Thoughts in Response to Pain (INTRP), and Pain Beliefs and Perceptions Inventory (PBPI) prior to participation in the cold pressor task. Following the cold pressor pretest to obtain a baseline tolerance, subjects were randomly assigned into either a positive self-statement training (PSST) or negative self-statement training (NSST) group. It was hypothesized that subjects in the PSST group would have greater increases in tolerance, threshold and pain ratings from pretest to posttest than

subjects in the NSST group. A repeated measures Multivariate Analysis of Variance (MANOVA) was significant at $p < .10$. A repeated measures Analysis of Variance (ANOVA) using Pain Sensitivity Range (PSR) was significant at $p < .02$. Numerous variables were suggested to enhance the strength of this relationship. These included extending the amount of time allotted for training and rehearsal of strategies, increasing subjects' self-efficacy, and allowing subjects to use preferred styles of coping. Depression was not found to be correlated with any pain variables. This is consistent with some recent literature which suggests a reexamination of current methods of assessing depression (e.g., BDI) in chronic pain patients.

INTRODUCTION

Incidence rates of depression among chronic pain patients have been estimated to be anywhere from 10% to 100% (Magni et al., 1994; Pilowsky et al., 1977; Romano & Turner, 1985; Turkington, 1980). Atkinson et al. (1991) reported that in 58% of patients with chronic low back pain the first episode of major depression followed the onset of pain. Several models have been developed to explain the existence of such a relationship, including the idea that pain is actually a form of masked depression. These individuals present with physical symptoms which cannot be explained adequately on a medical basis and depression-related explanations are thought to be most likely. Report of depressed mood is usually absent; however, patients may report neurovegetative symptoms of depression, such as sleep disturbance.

This concept of the 'pain-prone patient', first described by Engel (1959), suggests that certain individuals display psychodynamic features similar to depression-prone individuals. For these individuals, pain functions as punishment resulting from guilt over aggressive impulses. Pain, then, reduces the severity of the depression by

weakening the guilt. The pain-prone patient is characterized by the presence of continuous pain, denial of emotional and interpersonal difficulties, inability to tolerate success or happiness and depressive symptoms of anhedonia and sleep disturbances (Blumer & Heilbronn, 1982). Empirical evidence supporting this concept is lacking. However, patients have been described as having a social history characterized by a working class background and being raised under difficult circumstances requiring assumption of responsibility at an early age. Alcoholism is common among family members and patients may begin working at an early age, usually in physically strenuous jobs. They then work steadily until a relatively minor injury leaves them incapacitated. Adequate physical findings to account for the pain or its intensity are frequently absent and, thus, they may meet the criteria for somatoform pain disorder (Harness & Rome, 1989).

Rather than focusing on unconscious mechanisms, such as those described in the 'pain-prone' patient, behavioral models of depression have focused on the role of lack of positive reinforcement for adaptive behaviors. Similarly, operant models of pain focus on the behavior, rather than on the pain itself. In fact, nociception is not seen as necessary or sufficient for these behaviors to develop.

In this model, chronic pain occurs in a social context and is shaped by the behavior of others. Pain behaviors are

seen as being negatively reinforced by environmental factors such as attention, financial reward or avoidance of aversive behaviors (Fordyce, 1976). The development of depression in chronic pain patients then is seen as resulting from an interaction of these two factors. Thus, an individual may find himself or herself receiving increased attention for pain behaviors and avoiding previously held responsibilities, while at the same time receiving little positive reinforcement for independent activities. These patients would become hypervigilant for somatic distress signals, which through social reinforcement, would be maintained (Boureau et al., 1991).

The use of the tricyclic antidepressants in the treatment of chronic pain patients has often been cited as evidence for models which hypothesize that similar neurochemical mechanisms are involved in both disorders. It has been suggested that depression is associated with decreased monoamine activity (monoamine theory). Tricyclic antidepressants work primarily by blocking re-uptake of serotonin (5-HT) and norepinephrine, and have been linked to both affective disorders and the modification of pain perception (Hendler, 1982). However, it is unlikely that availability of the neurotransmitter is solely responsible for relief of depressive symptoms. Administration of antidepressants leads to almost immediate increases in neurotransmitters at the synapse; however, clinical

improvement of symptoms may take 3 to 6 weeks to emerge. Also, examination of the role of both pre- and post-synaptic receptor sites has led to information which is inconsistent with the original theory. For instance, increased availability of serotonin leads to down-regulation of receptors, making the system less sensitive to monoaminergic stimulation, rather than more sensitive as originally hypothesized (Hollandsworth, 1990).

Serotonin has also been linked to pain perception and can either be algesic or analgesic depending on the point in the nervous system at which it is released. Direct tissue damage leads to increased serotonin production, which is capable of activating nociceptors, receptors activated by painful stimuli. Additionally, serotonin causes pain when applied to a human blister base and can potentiate pain induced by bradykinin, an endogenous peptide which initiates pain (Campbell et al., 1989). However, it has been hypothesized that it is depletion of brain serotonin in the dorsal raphe nucleus, which may account for hypersensitivity to both pain and depression (Sternbach, 1976). Serotonin depletion is associated with heightened perception of pain (Hampf, 1989); whereas, augmentation leads to reduction in pain perception.

It appears that decreased availability of serotonin may, in part, be responsible for pain and depression individually. Recently, evidence has been found which may

link the co-occurrence of these disorders. Dietary deficiencies of tryptophan, the biochemical precursor to serotonin, alter pain sensitivities by decreasing neuronal opiate response due to a lowered concentration of serotonin (Haze, 1991). Also, depletion of plasma tryptophan has been found to eliminate the analgesic effect of morphine on tolerance to cold pressor pain (Abbott et al., 1992). More detailed analysis of the role of opioid receptors, including the role of endorphins, may shed light on the interaction between mood and pain perception.

Evidence supporting the role of serotonin in pain and depression is promising; however, there are a number of factors which need to be investigated before this relationship is clear. For instance, serotonin levels are elevated, rather than depleted, in migraine patients (Kreisberg, 1988) suggesting that all types of chronic pain may not have the same biological basis. Additionally, receptor subtype and location may influence the expression of drugs that interact with them. Ritanserin, a serotonin antagonist, which acts on 5-HT_2 receptors, has been shown to have both analgesic and antidepressant effects (Nappi et al., 1990), which is inconsistent with the notion that increases in serotonin lead to these effects. Additionally, interaction between serotonergic and adrenergic systems makes it difficult to examine these neurotransmitters independently.

In addition to neurotransmitter imbalances, many patients with depressive disorder have an excess secretion of cortisol, which fails to be suppressed in response to exogenous administration of dexamethasone (Reus, 1988). France et al. (1984) found that chronic pain patients who also met DSM-III criteria for major depression were dexamethasone non-suppressors. However, these results were not confirmed using a sample of fibrositis patients (Hudson et al., 1976), casting doubt on the significance of the dexamethasone suppression test. Additionally, the increased number of false positive results, such as those found in individuals diagnosed with dementia and schizophrenia, suggests further caution in interpreting these findings.

Fields (1991) has proposed a cognitive neurobiological model which integrates biological evidence for pain and depression with psychological factors. This model includes sensory, affective and evaluative components of pain. The sensory component results from nociceptor stimulation in peripheral tissues, which leads to activation of pain pathways. Activation in the peripheral nerve transmits impulses by means of the spinothalamic tract to the ventrobasal thalamus and then to the somatosensory cortex. Additionally, the pain modulating pathway, with nuclei in the periaqueductal gray, can be activated by opioids and is associated with opiate receptors.

Fields contends that there is evidence for bi-directional control of pain transmission. Cells in the medulla, known as off-cells, are inhibitory neurons to pain and account for analgesic effects of morphine. Another class of cells in the medulla, on-cells, have a facilitating effect on pain transmission. These cells are inhibited by administration of opiates; however, their firing rates increase to a rate that is higher than the pre-opiate rate in the presence of an opiate antagonist. In this context, the pain transmission system can be driven in the absence of peripheral stimulation by a noxious stimulus.

The affective component is activated by the same peripheral nociception as the sensory component, but then follows different pathways. It is thought that these pathways probably diverge from the somatosensory cortex and involve projections into the hypothalamus, medial thalamus, frontal cortex and limbic system. This activation of the affective pathway can lead to changes in mood, such as dysphoria.

The evaluative component of this model relates to the meaning that individuals apply to the pain. Cognitive strategies developed as a result of an individual's interpretation of their pain can affect pain intensity, thus making it appear milder or more severe than the nociceptive input alone. Thus, according to this model, the relationship of pain and depression can be explained by

these three components. Nociception alone can lead to activation of both sensory and affective pathways, leading to changes in sensory perception and mood, so that pain alone may lead to dysphoria. Furthermore, pain transmission can occur in the absence of painful stimuli and can be mediated by an individual's affect and cognition. Thus, the mere expectation that a stimulus will cause pain is enough to activate pain pathways.

Such cognitive factors have been important in the development of theories and treatment programs relevant to both pain and depression. Cognitive evaluation of a situation influences an individual's ability to cope with the stressful event (Lazarus & Folkman, 1984). Coping, then, involves not only what a person does in response to a stressor, but what a person thinks and says to himself/herself. Additionally, a person's belief in his/her own effectiveness influences whether he/she will attempt to cope with the situation (Bandura, 1977).

Beck (1967) contends that depression is the result of systematic negative distortions in cognitive processes which yield a negative view of the self, the world and the future. These distortions may involve overgeneralization, personalization, selective abstractions and dichotomous thinking. Similarly, pain patients who are faced with daily pain may develop distorted appraisals of their pain leading to a pattern of negative cognitions. For instance, an

individual's pain at any given moment may lead to the notion that they will be unable to participate in activities for the entire day (overgeneralization).

The next section will provide an overview of studies investigating the role of these negative cognitions in the development of depression in chronic pain.

COGNITIONS AND PAIN

Studies in this area have addressed a number of issues including what characteristics contribute to the development of depression in pain patients, whether cognitive distortions are related solely to the pain experience or more global in nature, and whether distortions are related to pain intensity or severity. A commonly cited study by Lefebvre (1981) examined cognitive distortions in depressed and non-depressed pain patients, depressed psychiatric patients and non-depressed patients without low back pain (LBP). The Cognitive Error Questionnaire (CEQ) was used to measure the extent to which individuals utilize cognitive errors. The CEQ consists of a series of vignettes followed by a cognition reflecting a cognitive error. Subjects are then asked to make a rating ranging from "almost exactly like I would think" to "not at all like I would think." The CEQ is composed of a General scale and a scale with themes relating to individuals with low back pain (LBP).

Depressed non-pain patients had higher Beck Depression Inventory (BDI) scores than depressed pain patients. However, these 2 groups did not show significantly different levels of general cognitive distortion. Depressed pain patients endorsed errors related to catastrophizing,

overgeneralization and selective abstraction significantly more strongly than depressed non-pain patients. LBP cognitive distortion, which are specifically related to a person's back pain, was not as strongly associated with depression as general cognitive distortion. Lefebvre concluded that depressed pain patients distort about general life experiences to about the same degree as their depressed non-pain counterparts.

Several studies by Smith and colleagues (Smith et al., 1986; Smith et al., 1988; Smith et al., 1990) have also utilized the CEQ to examine cognitive distortions in LBP and rheumatoid arthritis (RA) patients. Previous examinations of MMPI profiles suggested that LBP patients with elevations on Depression (D) demonstrated 2 profiles. One is characteristic of somatization, with elevations on Hypochondriasis (Hs) and Hysteria (Hy). The other is characteristic of general distress, with elevations on Psychasthenia (Pt) and Schizophrenia (Sc). Smith et al. (1986) found that general and LBP cognitive distortions were significantly related to elevations on D, Pt and Sc, concluding that cognitive distortion is a correlate of general cognitive distress, but not of somatization. Both types of distortion were also found to account for significant amounts of self-report and interview-rated depression independent of disease severity in a sample of RA patients (Smith et al., 1988).

Much of the pain-depression literature has focused on what factors may mediate the pain-depression relationship in an attempt to determine why some individuals are more susceptible to developing depression while experiencing chronic pain. Using the Automatic Thoughts Questionnaire (ATQ) (Hollon & Kendall, 1980) and the Positive Automatic Thoughts Questionnaire (ATQ-P) (Ingram & Wisnicki, 1988), Ingram et al. (1990) examined the role of both positive and negative cognitions and depression in chronic pain patients. Not surprisingly, depressed patients reported significantly more negative thoughts than non-depressed pain patients or controls. These negative thoughts were associated with the presence of depression, regardless of pain intensity. Of interest is the finding that non-depressed pain patients report significantly more positive thoughts than depressed pain patients or normals. This suggests that high levels of positive thoughts may serve as a buffer for emotional distress resulting from chronic pain.

Chronic pain patients are often viewed as a homogenous group, even though the characteristics of these patients can vary greatly. Although low back pain and RA patients are frequently studied as a group, chronic pain samples have been shown to be quite heterogeneous. Gil et al. (1990) developed the Inventory of Negative Thoughts in Response to Pain (INTRP) to examine the relation of negative thinking patterns to pain and psychological distress in 3 pain

populations: sickle cell disease (SCD), RA and chronic pain. Factor analysis of this measure yielded three factors: Negative Self-Statements, Negative Social Cognitions and Self-Blame. Patients scoring high on the INTRP had higher levels of depression, anxiety, somatization, obsessive-compulsiveness, interpersonal sensitivity, paranoid ideation and psychoticism. Chronic pain patients scored significantly higher on Negative Self-Statements than SCD or RA patients. Additionally, chronic pain patients scored significantly higher on Negative Social Cognitions than RA patients and reported lower levels of control over negative thoughts than did SCD patients.

Passive coping strategies such as catastrophizing have been related to higher levels of depression (Brown et al., 1989; Keefe & Williams, 1990; Weickgenant et al., 1993) and higher reports of pain intensity (Wilkie & Keefe, 1991; Turner & Clancy, 1986). Catastrophizing refers to an individual's tendency to overexaggerate negative aspects of a situation and is most commonly measured by the Coping Strategies Questionnaire (CSQ) (Rosenstiel & Keefe, 1983), which assesses the extent to which subjects report using 6 cognitive and 2 behavioral coping strategies when they felt pain. The catastrophizing subscale is designed to measure negative self-statements and catastrophizing thoughts. Patients scoring high on this scale demonstrate higher levels of functional impairment, higher ratings of pain and

higher levels of depression (Keefe et al., 1989). Catastrophizing scores are able to predict long-term depression after controlling for initial level of depression (Keefe et al., 1990).

The use of catastrophizing has also been associated with lower pain tolerance (Spanos et al., 1979). Pain tolerant individuals (able to endure 5 minutes of cold pressor task) were less likely than pain-sensitive individuals (able to tolerate for an average of 60 seconds) to use catastrophizing as a coping strategy (Geisser et al., 1992). Although, there is current debate over whether catastrophizing by itself is a predictor of depression or merely a symptom of depression (Jensen et al., 1991; Affleck et al., 1992; Sullivan and D'Eon, (1990), a recent study by Geisser et al. (1994) found that catastrophizing played a significant role in mediating the relationship between evaluative and affective aspects of pain.

In addition to a person's negative cognitions, attributions of successes and failures have also been hypothesized as a contributing factor in the development of depression (Abramson et al., 1978). According to this theory, success is attributed to specific, unstable, external factors; whereas, failure is attributed to global, stable and internal factors. Depression in chronic pain patients has been found to be related to an internal, stable, global style for negative events only (Love, 1988).

Additionally, depressed pain patients are more likely to endorse negative self-attributions than non-depressed pain patients (Holzberg et al., 1993).

These studies suggest that the cognitive aspects of pain and depression may provide important suggestions to the development of treatment programs which adequately address both issues. Distortions were not found to be specific to pain. Rather depressed pain patients were found to be similar to depressed non-pain patients in their use of cognitive distortions and errors. This is consistent with a cognitive-behavioral approach to depression, which would maintain that such individuals are likely to adopt negative patterns of viewing many areas of their life. These distortions appear to account for depression independently of disease severity or pain intensity. Additionally, cognitive distortions may be related to psychological distress in general, and not just depression.

Previous studies investigating the role of negative thoughts in pain patients have been retrospective in nature. The main purpose of the study will be to assess the role of cognitions in pain through the implementation of self-statement training (SST), using either negative or positive cognitions during the cold pressor task. Cold pressor pain is produced by immersion of a limb in very cold water. It produces severe pain that increases quickly and is tolerated for a relatively short period of time (Gracely, 1989). If

negative thoughts are related to pain tolerance in chronic pain patients then it should be possible to manipulate those thoughts in such a way as to increase a patient's tolerance to the painful stimuli. This appears to be the first step in the larger task of addressing the role of cognitions and depression in pain patients, which this study will not directly address. This next section will provide a general review of self-statement training, with emphasis on studies relating to cold pressor pain.

SELF-VERBALIZATION AND PAIN TOLERANCE

In order to assess the role of self-verbalization and pain tolerance, it is first necessary to introduce stress inoculation training (SIT). Developed by Meichenbaum (1977), SIT has been successfully used in the management of pain and its principles are commonly incorporated into self-statement training programs. Meichenbaum (1977) proposed three phases: education, rehearsal, and application training. During the education phase of SIT, participants are provided with a conceptual framework for understanding the nature of the individual's response to stressful events. Melzack and Wall's three factor conceptualization of pain (sensory-discriminative, motivational-affective and cognitive-evaluative) is often presented during this time (Melzack, 1973). Subjects are encouraged to view their response as a series of phases consisting of preparing for the stressor, confronting or handling the stressor, possibly being overwhelmed by the stressor and self-reinforcement for successful coping.

Cognitive coping strategies are introduced to the subject during the rehearsal phase. Participants learn to monitor negative and self-defeating statements and replace them with positive coping statements. Subjects are

encouraged to generate their own statements for use during a stressful situation. Additionally, subjects are trained in procedures, such as relaxation, which will decrease physiologic arousal. Finally, subjects are encouraged to use their coping skills during a stressful situation in the application training phase.

It is not yet clear which components of SIT are most effective in increasing pain tolerance. Girodo and Wood (1979) assigned 70 undergraduates to one of four conditions: SIT rationale while hypnotized, rationale while awake, hypnotic induction only and simple instructions to repeat self-statements before posttesting. These authors found an increase in duration scores from pretest to posttest but no significant differences between groups. Self-statements and hypnosis were independently capable of reducing perceptions of cold pressor pain. Subjects who received instructions to use self-statements alone coped no better than controls, although they reported the same number and frequency of self-statements as other groups. This suggests that self-statement training is enhanced by the provision of information relating to the efficacy of self-statement training in pain management.

Vallis (1984) performed a complete component analysis of SIT using cold pressor pain and 80 undergraduate females. All conditions which included skills acquisition demonstrated a significant increase in tolerance as a

function of training (without corresponding increases in amount of reported discomfort). The education-alone condition, which used the 3 factor conceptualization of Melzack and Wall, also demonstrated significant improvement in tolerance. Additionally, data from unstructured questionnaires indicated that treatment led to decreases in the use of catastrophizing strategies, from pre-treatment to post-treatment, although it is unclear how this was assessed.

Worthington (1978) used 90 female undergraduates and cold pressor to examine pleasant versus neutral imagery, choice (allowed to chose own imagery) versus yoked (instructed to use imagery of subject they were yoked to) and pre-planned explicit self-verbalization versus no self-verbalization. The use of pleasant imagery did not lead to greater tolerance than the use of neutral imagery. Subjects who had a choice of imagery had greater tolerance gains than the subjects to whom they were yoked. Subjects who heard pain conceptualized as a 3 stage process and then explicitly planned self-verbalizations that they intended to use during each stage had greater tolerance gains than subjects who only heard the conceptualization and then repeated it back to the experimenter (no self-verbalization). However, there were no changes in self-report of pain intensity.

Shumate and Worthington (1987) examined the effectiveness of and self-verbalizations using positive

self-verbalization (PSV) (planned positive task-relevant self-instructions), negative self-verbalizations (NSV) (trained to identify and refute maladaptive thoughts), combined self-talk (combination of positive and negative self-verbalization groups), and information (provided with information regarding pain). Positive self-verbalization training was effective in increasing positive thoughts in both PSV only and combination groups. Likewise, NSV training was effective in decreasing negative thoughts in NSV only and combination groups. Increases in cold-pressor tolerance were associated with increased positive self-talk, regardless of experimental condition. Reports of pain and emotional distress were not decreased by cognitive techniques. However, subjects reported a decrease in maximum pain felt during posttest irrespective of group assignment.

This review has attempted to focus on those studies examining self-statement training in the context of SIT. Although experimental procedures may be varied, these studies provide evidence that self-statements are effective in reducing cold-pressor pain and lead to increased tolerance. Additionally, the use of self-statements has been found to lead to decreases in the use of catastrophizing. However, the use of these statements does not seem to affect patient ratings of pain intensity.

The studies reviewed here have tended to use undergraduate students as subjects. SST used during this study was developed based on the recommendations and findings of these studies. The current study used pain patients as subjects in an attempt to determine how these patients react to a painful experimental stimulus and what role their cognitions play in their coping.

METHOD

Subjects

Subjects were 58 adult chronic pain patients recruited from the Parker Mahan Facial Pain Center at the University of Florida. All subjects were between age 18 and 65 and had current facial pain resulting from TMD. Typical primary diagnoses included myofascial pain syndrome, bruxism/clenching, noxious occlusion, fibromyalgia, degenerative arthritis and disk displacement. Seventeen subjects (29%) reported headaches as a secondary diagnosis.

Patients were approached in clinic prior to their appointment and asked to participate in a study investigating the role of cognitions and pain. Individuals meeting the following criteria were excluded from participation in the study: a) pain related to a malignant process, such as cancer -- 0 subjects excluded; b) pain duration of less than 6 months -- 5 subjects; c) pain in the upper extremities -- 25 subjects; and d) history of severe cardiovascular disease -- 1 subject.

Demographic information can be found in Table 1. The average age at time of study was 39.3 (*SD* = 11.7). Average pain duration reported was 97.7 months (*SD* = 95.7).

Table 1

Demographic Information for PSST and NSST Samples

	PSST	NSST
Variable	n	n
GENDER		
Females	25	24
Males	4	5
HANDEDNESS		
Right	27	26
Left	2	3
RACE		
White	28	28
Black	1	0
Other	0	1
MARITAL STATUS		
Single	7	8
Married/living together	18	20
Divorced	3	1
Widowed	1	0
EDUCATION (in years)		
<12	1	0
12	10	10
12-16	18	17
>16	0	2
EMPLOYMENT STATUS		
Employed	18	17
Not-employed	11	12

Treatments for pain prior to presentation in the clinic can be found in Table 2.

Procedure

Part I: Pretest. Prior to participation in the cold-pressor task, subjects completed a consent form which outlined the procedures of the study. Subjects were allowed to decline participation at any time during the procedure. Additionally, subjects were administered the Beck Depression Inventory (BDI), Pain Beliefs and Perceptions Inventory (PBPI), Inventory of Negative Thoughts in Response to Pain (INTRP) and the demographic questionnaire. The cold-pressor apparatus consisted of a cooler fitted with a screened divider. This cooler was filled with cold water and ice was placed in one side of the device. The water was circulated using a dc bilge pump, which maintained the water at a constant temperature of 1-4 degrees Celsius.

Subjects were seated in a comfortable chair, given a brief description of the procedure, and asked to remove all jewelry and watches from their non-dominant hand. They were instructed to place this hand with the palm facing down in the compartment not containing ice, so that the top of the water was midway between their wrist and elbow. Subjects were instructed to say 'pain' at the point at which they first experienced pain, and then to keep their hand in the water for as long as possible. Subjects were asked to make pain ratings at 10 second intervals during the task using a

Table 2

Treatments Received Prior to Facial Pain Clinic Evaluation

Treatment	%
Medication	41
Splints	34
Physical Therapy/Massage	33
Surgery	15
Braces	12
Extractions/Root canals	10
Chiropractor	10
Injections/Nerve blocks	9
Biofeedback/Psychological	9
Acupuncture	7
TENS	3
No Treatment	15

*Subjects may be in more than one category

pain rating device, described elsewhere. Prior to beginning the pretest subjects completed a current pain VAS (CP I). The experimenter recorded pain threshold and tolerance in seconds. Subjects maintaining their hand in the water at 300 seconds were asked to remove it. Immediately following the task, subjects were asked to make pain ratings using VAS-intensity (Sensory I) and VAS-unpleasantness (Affect I) scales.

Part II: Posttest. Subjects were randomly assigned to either the Positive Self-Statement Training (PSST) group or Negative Self-Statement Training (NSST) group. Both groups were provided a rationale supporting the use of either positive or negative coping statements in the management of pain. This was followed by rehearsal of statements chosen by the subject from a pre-determined list. Subjects were then asked to choose one statement to use during the task. They were instructed to repeat this statement aloud during the posttest.

Training for both groups took approximately 7-8 minutes. As in the pretest, subjects completed a current pain VAS (CP II) immediately prior to participation in the posttest. Upon completion of the posttest, subjects completed VAS Intensity (Sensory II) and VAS Unpleasantness (Affect II), and VAS ratings of clinical pain (CLP) and rationale effectiveness.

Following participation, all subjects were debriefed concerning the nature of the study. Special consideration was given to providing the NSST group with information regarding the use of appropriate coping statement for the management of pain (See appendix for all scripts).

Measures

Beck Depression Inventory (BDI) (Beck & Steer, 1987). The BDI is a 21-item questionnaire which measures presence and severity of depression. It contains questions concerning depressive symptoms, such as feelings of guilt and worthlessness, irritability, social withdrawal, sleep and appetite disturbances and quality of mood. Each item consists of 4 statements which rate symptoms in severity from 0 (least severe) to 3 (most severe). Sums of all items yield a total score which may range from 0 to 63. Test-retest reliability ranges are .48 - .86 for psychiatric samples and .60 - .83 for non-psychiatric samples. Internal consistency is .86 and .81 for psychiatric and non-psychiatric samples, respectively.

Inventory of Negative Thoughts in Response to Pain (INTRP) (Gil et al., 1990). This 21-item questionnaire assesses subjects' responses to pain flare-ups. Respondents indicate on a 5-point Likert scale how frequently they have negative thoughts during flare-ups. These cognitions fall into three categories: negative self statements, negative

social cognitions and self-blame. Cronbach's coefficient alphas range from .73 to .91, suggesting that each of the scales possesses satisfactory internal consistency.

Pain Beliefs and Perceptions Inventory (PBPI) (Williams and Thorn, 1989). This 16-item questionnaire assesses beliefs which have developed as the result of persistent pain. These beliefs may differ from previously held cultural or personal beliefs about pain. The PBPI is composed of 4 belief scales. Mystery measures the belief that pain is a mysterious, aversive event that is poorly understood. Self-blame assesses the degree to which patients believe that they are to blame for their pain. The remaining 2 belief scales, Permanence and Constancy, were originally one scale (Time) which described the belief that pain is and will be an enduring part of life (Williams, et al., 1994). Constancy is concerned with temporal aspects of pain, such as whether it is constant or remittent. Permanence assesses the degree to which a patient has accepted pain as a permanent part of life. Respondents are asked to indicate how closely they agree with each statement by using a 4 point Likert scale (-2, -1, 1, 2) ranging from strongly disagree to strongly agree.

In addition to the above questionnaires, subjects were asked to complete a questionnaire containing information on demographic variables, such as age, race, education, and marital status. Additionally, subjects were asked to report

information concerning diagnosis, pain duration and severity and medication use at time of appointment.

Pain measures. Pain threshold was measured as the amount of time it took the subject to report pain during the cold-pressor task. Pain tolerance was defined as the total amount of time subjects maintained their hand in the water. Pain sensitivity range (PSR) was defined as tolerance minus threshold for each trial. A series of visual analog scales (VAS) were used to obtain ratings for pain (intensity, unpleasantness, current pain and clinical pain) and effectiveness of rationale. All VAS scales were 10 cm. in length with verbal anchors. For example, VAS-intensity assessed subjects' ratings of pain intensity and range from "no pain at all" to "worst imaginable pain." Subjects were asked to make a mark on the line which best represented their experience.

Typically, in studies assessing pain perception, subjects make oral pain ratings at 10 second intervals. Due to the verbal nature of the intervention (repeating a statement aloud), this was viewed as a possible confound. Therefore, a pain rating device using a pressure sensitive bladder was used to obtain pain ratings during the task. Subjects pressed on the bladder using their dominant hand. The bladder was connected to an air pressure sensor (transducer) through a small tube. Air pressure was converted to a voltage level by means of an analog to

digital converter housed within an HC11 microprocessor. Data was downloaded to a laptop computer for later analysis. This device required 20 pounds of pressure to reach a maximum voltage of 5 volts. This provided an added benefit of eliminating possible ceiling effects seen in the use of anchored VAS scales.

RESULTS

Standard techniques were used to compute each individual's scores on the BDI, PBPI and the INTRP. Statistical Package for the Social Sciences (SPSS) was used to analyze the data. Group comparisons were first conducted to determine if the two groups differed significantly from one another on the demographic and pain variables. Chi square analyses were used to analyze categorical variables (gender, race, education, marital status, and handedness). Independent samples t-tests were used to compare age, pain duration, weekly pain (number of days per week subject experiences pain), daily pain (number of hours during day that pain episodes last), threshold, tolerance and VAS ratings. Results revealed that groups differed significantly on rationale effectiveness t (56) = 6.44, p < .0001. All other comparisons were non-significant. Means and standard deviations for pain variables can be found in Table 3. Means and standard deviations for psychosocial variables can be found in Table 4.

The primary hypothesis being addressed by this study was that subjects in the PSST group would have greater increases in tolerance, threshold and pain ratings from pretest to posttest than subjects in the NSST group. A

<u>Table 3</u>

<u>Means and Standard Deviations for Pain Variables</u>

	PSST		NSST	
Variable	Mean	SD	Mean	SD
Durations (months)	82.69	105.38	112.69	84.20
Weekly Pain	5.78	1.62	6.86	.45
Daily Pain	8.03	5.04	10.98	8.69
Current Pain I	2.92	2.53	4.22	3.08
Current Pain II	3.08	2.65	3.83	3.20
Sensory I	6.24	2.04	6.09	2.76
Sensory II	6.71	1.47	6.54	2.69
Affective I	7.37	1.97	7.44	2.27
Affective II	7.29	1.81	7.71	2.26
Peak I (volts)	1.81	.18	1.78	.20
Peak II (volts)	1.81	.20	1.83	.28
Threshold I (sec)	49.03	55.72	71.07	96.84
Threshold II (sec)	52.76	60.96	86.55	101.38
Tolerance I (sec)	94.17	90.52	119.45	119.06
Tolerance II (sec)	118.41	104.65	111.10	107.27
PSR I (sec)	45.14	76.50	48.38	75.59
PSR II (sec)	65.66	87.90	24.55	
35.64				
Clinical Pain	4.27	2.96	4.33	3.42
Rationale Effectiveness	7.08	2.33	2.76	
2.76*				

*$p < .0001$

Table 4

Means and Standard Deviations for Psychosocial Variables

Measure	Mean	SD
BDI TOTAL	11.98	7.92
Cognitive	5.84	4.35
Somatic	6.14	4.37
PBPI SCALES		
Constancy	1.75	4.24
Permanence	-.55	4.17
Mystery	2.00	3.92
Self-Blame	-4.07	2.35
INTRP SCALES		
Negative Self-Statements	.93	.69
Negative Social Cognitions	1.44	.81
Self-Blame	.77	.80

repeated measures Multivariate Analysis of Variance (MANOVA) was used to test this hypothesis. Three dependent variables were used: threshold, tolerance and peak pain ratings. No main effects were found to be significant. A group by time interaction was found $F(3,54) = 2.66$, $p = .057$. PSR scores were calculated to assess subjects' sensitivity to the painful stimulus. A repeated measures Analysis of Variance (ANOVA) using these scores revealed a group by time interaction, $F(3,54) = 6.15$, $p < .02$. No main effects were found to be significant.

Correlation coefficients were calculated to determine the relationship between pre-test threshold and tolerance times and psychosocial variables. Results can be found in Table 5. Pre-test tolerance and threshold were not found to be correlated significantly with any psychosocial variables. Depression, as measured by the BDI total score, was significantly correlated with all INTRP scales and PBPI Permanence. Individual scales for INTRP and PBPI were intercorrelated. PBPI Permanence was significantly correlated with INTRP Negative Self-statements and Social Cognitions. PBPI Self-Blame was significantly correlated with INTRP Negative Self-statements and Self-blame.

Table 5

<u>Intercorrelations between pre-test threshold and tolerance and psychosocial variables</u>

Measures	2	3	4	5	6	7	8	9	10
1. Tol	.69**	-.05	.22	-.15	-.03	.08	-.04	-.12	.03
2. Thr		.07	.17	-.13	.07	.22	.11	.09	.01
3. BDI			.24	.09	.35*	.31	.62**	.64**	.35*
4. Con				-.03	.14	.08	.29	.25	.11
5. Mys					.07	.01	.06	.26	.10
6. Perm						.35*	.41**	.50**	.26
7. PSB							.39*	.28	.66**
8. SS								.70**	.44**
9. Soc									.37*
10. SB									----

*$p < .01$
**$p < .001$

Tol=tolerance; thr=threshold; BDI=BDI total; Con=PBPI constancy; Mys=PBPI mystery; Perm=PBPI permanence; PSB=BPI self-blame; SS=INTRP negative self-statements; Soc=INTRP negative social cognitions; SB=INTRP self-blame

DISCUSSION

The hypothesis that subjects in the PSST group would have significant increases in tolerance, threshold, and pain ratings during the cold pressor from pretest to posttest was partially confirmed by this study. The repeated measures MANOVA was significant at $p < .10$ and the repeated measures ANOVA using PSR scores was significant at $p < .02$. Analysis of data obtained from the ANOVA reveal changes in pain perception in the proposed directions, with PSST subjects increasing their time from pretest to posttest and NSST subjects decreasing their time.

An important consideration of any study is whether the constructs being examined are valid. Three major constructs were examined in this study: threshold, tolerance and pain ratings. Threshold emphasizes the discrimination of nociceptive quality, assessing at what point a stimulus is perceived as painful. Tolerance is an expression of unwillingness to receive more intense stimulation. Harris and Rollman (1988), using a multi-trait, multi-method procedure found that threshold and tolerance, while related, do not tap identical components and each has validity as a trait. These remain fairly consistent within an individual, when exposed to different pain induction methods. The

definitions of tolerance and threshold used in this study are consistent with those of other studies in the literature and are viewed as appropriate.

The pain rating device used in the study is novel. As previously stated, this device was seen as superior to those used in previous studies, in that it would eliminate ceiling effects and make it possible to report pain ratings without interference to the verbal intervention. However, its validity has not been determined and, therefore, it is not possible at this point to assess the device's potential as a valid measure of pain ratings. The sampling rate of the microprocessor allowed for the recording of over 180 increments between the baseline voltage of 1.5 volts and maximum possible rating of 5 volts. It is possible this high sampling rate, coupled with demands of the pressure sensor, which required 20 pounds of pressure to reach 5 volts, made it difficult to demonstrate a group difference due to the small variability in ratings over time.

The hypothesis related to pain ratings proves difficult to examine. Two theories have been proposed. It has been reported that increased tolerance leads to increased reports of pain (Williams & Kinney, 1991). It has also been suggested in the literature that cognitive interventions, such as those used here, do not effect pain ratings (Worthington, 1978). Of the two groups, the PSST group was hypothesized to have increases in tolerance times from

pretest to posttest. Therefore, it was hypothesized that PSST pain ratings would increase, due to the increased length of exposure to the painful stimulus, in comparison to the NSST group. However, it could also be argued that the NSST group would have increases in their pain ratings due to the negative cognitions. If both of these postulates are true then there would be no difference between the groups. Clearly further examination of this measure is needed and no definite conclusions can be drawn.

Perceived control is the belief that one has at one's disposal a response that can influence the aversiveness of an event (Thompson, 1981). Keefe and Brown (1980) have proposed that pain patients' perceptions of their ability to control their pain decrease as they move from the acute, to the pre-chronic and finally chronic phases. This study did not control for patients' belief that they could impact their pain. Crisson and Keefe (1988) report that patients who hold a chance orientation to control (e.g., believe that chance is responsible for their pain) felt more helpless to deal with their pain.

Litt (1988) has suggested that cognitive strategies designed to modify pain tolerance should be effective to the extent that they enhance self-efficacy expectations. Self-efficacy refers to one's confidence in his or her ability to behave in such a way as to produce a desirable outcome (Bandura, 1977). Comparing relaxation training, cognitive

coping skills and a pain irrelevant task, Cassens et al. (1988) found relaxation and cognitive treatments to only be effective when they were accompanied by positive feedback. In his study, Litt (1988) found the longest tolerance times were observed in subjects who perceived high control over their situation and had high confidence in their ability to use that control. The question then arises - Does the current study change subjects' perceptions of their ability to control their pain?

Subjects in both the PSST and NSST groups are told that the strategy that they are being instructed to use "may be effective" in increasing their tolerance to pain. This suggests that the lack of difference between the groups could be related to the fact that both groups believe that they will be able to control their pain using the statements assigned to them. However, a significant difference was noted between the groups for subjects' report of the effectiveness of the rationale, with subjects in the NSST group rating their intervention as significantly less effective than subjects in the PSST group, t (56) = 6.44, $p < .0001$. Thus, self-efficacy theory would suggest that individuals in the NSST group would likely have lower ratings of self-efficacy than their PSST counterparts and therefore the difference between the two groups should have been enhanced.

Research suggests that an individual's choice of coping statements is important in the management of pain (Beers & Karoly, 1979; Turk & Rudy, 1986). However, some previous studies have not found the use of self-statements alone to be effective in managing pain (Hacket & Horan, 1980; Worthington & Shumate, 1981). Closer examination of the Worthington and Shumate article revealed that the intervention was used by only 26% of the subjects in that condition. In fact, it has been noted that difficulties in the assessment of cognitive approaches to pain arise because subjects spontaneously use their own cognitive coping strategies when faced with noxious stimulation (Tan, 1982). This study attempted to alleviate this problem by having subjects state aloud the coping statements to ensure that they were using only the coping mechanisms required by the study. However, it may not have capitalized on subjects use of their own preferred coping strategies.

Using a meta-analysis, Dush et al. (1983) found that self-statement training alone is not as effective as when it is combined with other modalities. This is consistent with the trends in our data which show that the PSST group did increase their tolerance times, while those in the NSST group decreased their tolerance times, from pretest to posttest. However, the difference was not found to be significant and would have likely been enhanced by the addition of other coping strategies, such as relaxation or

possibly even allowing subjects to choose their own coping statements.

Distraction has been found to be an effective means of enhancing tolerance to cold pressor stimulation (Williams & Kinney, 1991). It is possible that with an acute pain stressor, the use of negative coping statements does not prove to be a disadvantage over positive statements due to the distraction component it provides. Anecdotally, when asked to make ratings of the effectiveness of the rationale, subjects in the NSST group would often comment that it helped to distract them, but was not very effective in helping them to deal with the pain. McCaul and Malott (1984) reported that distraction is effective for dealing with acute pain, especially laboratory pain.

What contribution do psychological variables such as depression, anxiety or the use of negative thoughts contribute to the measurement of tolerance and threshold? Many studies have found catastrophizing to be related to depression and to decreased tolerance times. Correlation coefficients were calculated to determine the relationship between pretest tolerance and threshold times and psychosocial variables (e.g., BDI, INTRP, PBPI). Tolerance and threshold were not found to be correlated significantly with any psychosocial variables. This is consistent with a study by Boureau et al. (1991) which found no correlation between the BDI and pain measures when assessing nociceptive

reflex in chronic pain patients. However, it raises some interesting questions about the use of paper and pencil instruments to measure depression and pain in chronic pain patients. Scores on the BDI are often elevated in these patients due to increased somatic complaints (Williams & Richardson, 1993) and it has been suggested that the cut-off score be increased to identify depression in these patients (Turner & Romano, 1984). Paper and pencil measures (BDI, INTRP, PBPI) were intercorrelated, suggesting that they are measuring related aspects.

Although there is currently a large group of literature suggesting a higher than normal rate of incidence of depression within the chronic pain population, additional studies have found a weak relationship (Garron & Leavitt, 1983; Kerns et al., 1983; Pilowsky et al., 1977). When depression is reported among chronic pain patients, it is typically expressed as mild depressive symptoms rather than meeting the criteria for major depressive disorder (Skevington, 1993). It has been suggested that chronic pain and depression are best seen as independent phenomena due to the difficulties in making definitive statements about the extent and nature of their relationship (Craig, 1989).

Anxiety is often the primary emotional reaction to an acute pain experience. In fact, autonomic arousal patterns are similar in both pain and anxiety and may be difficult to distinguish (Gross & Collins, 1981) and increased levels of

anxiety are related to increased reports of pain (Cornwall & Donderi, 1988; Jamison et al., 1987). No attempt was made to control for anxiety in this study; however, it is possible that subjects in this study experienced little anxiety regarding the painful experience. By the second trial, subjects are familiar with the sensations of cold pressor and recognize that they can remove their hand from the apparatus at any time, thus terminating the stressor. Second, subjects who found the prospect of cold pressor pain to be too overwhelming and, therefore, anxiety producing most likely opted not to participate rather than to be exposed to such emotional, as well as physical discomfort.

No attempt was made in this study to control for potential physiological variables which may have contributed to the outcome. For example, high blood pressure has been found to be correlated with diminished pain sensitivity (Ditto et al., 1993). It is also unclear what impact the physiologic effects of prolonged pain on the nervous system might have with regard to threshold and tolerance. There are at least two theories which attempt to explain chronic pain patients' response to pain. Adaptation theory hypothesizes that pain patients evaluate pain within the context of their previous experience, predicting that they would have higher thresholds than controls because of their extensive history dealing with pain. The opposing theory, postulates that pain patients should demonstrate lower pain

thresholds due to their hypervigilance to somatic distress signals.

Studies have found support for both the adaptation model (Cohen et al., 1983; Naliboff et al., 1981; Zamir & Shuber, 1981) and the hypervigilance model (Malow et al., 1980; Malow & Olson, 1981). It has been suggested that discrepancies between these studies could be explained by the differences in methods being used (Cohen et al., 1983). Designs supporting the adaptation model used repeated presentations of radiant heat, while Malow's studies used a focal pressure stimulator which applied a constant pressure, leading to steady increases in pain intensity. Without comparison to a control group, it is unclear what role these theories play in this sample. However, the current study using the cold pressor would seem to be more similar to those using the focal pressure stimulator.

Finally, some comments should be made about the sample itself. This sample was predominantly white and well-educated. It was comprised of a 5:1 ratio of females to males. This is consistent with the literature which reports that although gender differences for TMD symptoms are absent in a non-clinical population (Glass et al., 1993), females comprise the largest proportion in clinical settings (Southwell et al., 1990). The basis for this inconsistency remains speculative.

The findings of this study have implications for both the clinician and researcher. The trend toward significance of the MANOVA and the signficant finding regarding pain perception indicates that a relationship exists between the use of coping statements and tolerance. Numerous applications are possible for strengthening this relationship. It appears that increasing the time available for training may be most important clinically. Learning theory suggests that patterns of behavior, including cognitive coping, are developed over time as the result of numerous environmental factors (e.g., positive reinforcement) and may be difficult to change. Subjects in this study demonstrated a broad range of pain duration from 6 months to 45 years, with mean duration of 97.7 months. The use of positive coping statements may require not only the learning of new skills for dealing with a painful experience, but the unlearning of old maladaptive patterns. Obviously, one hopes to have available a sufficient amount of time to work with a patient on developing these new strategies. Experimentally, increasing the time available for training would appear to have benefits as well. Increasing both the time allotted for self-statement training and the number of trials would have the benefit of building more rapport with the patient and insuring that the patient has adequate competency in the use of self-statements.

This additional training time may also serve to enhance a patient's feelings of self-efficacy in coping with their pain. Future research examining the role of negative vs. positive cognitions which include a self-efficacy component, such as providing patients in both groups with negative or positive feedback, would allow further examination of not only the importance of such feedback, but also allow for a better understanding of cognitive coping strategies.

Several studies suggest that matching a patient's intervention with their preferred coping style may be more effective in dealing with a stressful procedure (Auerbach et al., 1976; Martelli et al., 1987; Shipley et al., 1979). The distinction between relevant vs. irrelevant strategies for pain appears to be important, with relevant strategies leading to increases in pain threshold (Spanos et al., 1975) and lower ratings of pain intensity (Rybstein-Blinchik, 1979). The intervention used in this study was purposely brief and limited to simple sentences of roughly the same length. Statements were presented in a forced choice format so that subjects were not allowed to incorporate their own means of coping. Clinically, of course, one would want to maximize a patient's coping response so that patients would have a variety of coping statements from which to choose. Experimentally this could be achieved by providing a broader range of statements which are more specifically related to the painful experience and allowing patients to use more

than one statement during the task. Alternatively, subjects could generate a list of statements, either alone or in conjunction with the experimenter, to be used during the task.

Finally, combining self-statements with other modalities, such as relaxation training or even biofeedback, would prove to be beneficial. This could easily be incorporated into self-statement training through the use of verbal prompts for relaxation.

APPENDIX

INTRODUCTION-BOTH GROUPS

"In a few minutes, I'm going to ask you to participate in a study which examines how individuals cope with pain by having you place your hand in some ice water. You may decline to participate at any time during the procedure without penalty."

*Determine non-dominant hand.

*Ask subject to remove all jewelry and watches from non-dominant hand.

"In a minute, we will begin the task. When I tell you, please place your left/right hand in the ice chest so that your palm is facing down and the water comes midway between your wrist and elbow. During the task, you will use this device to indicate ratings of pain or discomfort. Think about it like this. When the bulb is resting in your hand, it indicates that you feel no pain at all. When the bulb is squeezed as hard and firm as possible, that would indicate worst imaginable pain. There are lots of points in between. Now let's take some time to practice, so that you can have an accurate feel of how the bulb works. Place the bulb in your hand like this and squeeze it so that you can feel the varying degrees of tension." (Give practice trials). "Be

careful that you do not cover up the hole on the end of the bulb. During the task, I will be asking you to make ratings of your pain or discomfort using the bulb. Each time you hear me say 'rating' squeeze the bulb to indicate your level of pain or discomfort at that time. Remember that when it is resting in your hand that indicates no pain.

The bulb helps you to indicate your level of discomfort at times during the task. I'd also like you to indicate when you first feel pain by saying the word 'pain' out loud so that I can hear you, then keep your hand in the water for as long as you can before removing it. After the procedure I'll ask you some information about your experience during the task."

*Ask subject if he/she has any questions, repeat if necessary.

*Rating of current pain VAS.

** Following procedure, administer pain ratings -I.

PSST SCRIPT

"In a few minutes, you will be asked to repeat the cold pressor task in the same manner as before, but this time I'd like you to try some techniques which many people find helpful when faced with a painful experience.

What you say to yourself during a painful event can affect the way you experience pain. Positive thoughts can help you to feel better about your ability to deal with a

painful experience. For instance, if you focus on positive thoughts, such as 'This is not that bad. I can do this. I am almost through.' you will be able to perceive the pain as more manageable and more easily endured. By focusing on these positive thoughts, you will have a more realistic view of your situation and may be more able to deal with the difficult experience of the painful task.

We would like you to repeat a statement out loud which focuses on positive thoughts, so that the painful experience can be made less intense and more easily endured.

Here is a list of statements which people have found effective in coping with pain." *Present note card to subject.

"Please follow along with me, as I read them out loud." *Read statements from note card.

"One step at a time, I can handle it.

I just have to remain focused on the positives.

It won't last much longer.

No matter how bad it gets, I can do it.

It will be over soon.

This isn't as bad as I thought."

"Please pick one statement that you'd like to use for practice. Now imagine that you are getting ready to place your hand in the ice chest. Practice saying this statement out loud so that I can hear you. Say the statement at a pace which is comfortable for you." *Repeat using new statement.

"We are just about ready to begin. Please pick one statement that you'd like to use during the task. (Record statement on data sheet). Please use only that statement by repeating it out loud during the task. Say the statement at a pace that is comfortable for you. Continue to use the statement until you remove your hand from the water. Once again, I will also be asking you make pain ratings using the bulb. Each time you hear me say 'rating' squeeze the bulb to indicate your level of discomfort or pain at that moment. Also, remember to indicate when you first feel pain by saying the word 'pain' out loud so that I can hear you. Then keep your hand in the water for as long as you can before removing it."

*Rating of current pain VAS-II.

*After completion of task, administer pain-ratings-II, rating of clinical pain and effectiveness of rationale VAS.

*Do debriefing.

NSST SCRIPT

"In a few minutes, you will be asked to repeat the cold pressor task in the same manner as before, but this time I'd like you to try some techniques which many people find helpful when faced with a painful experience.

What you say to yourself during a painful event can affect the way you experience pain. For instance, your natural tendency might be to focus on negative thoughts

regarding the pain, such as 'This is terrible, I can't take this anymore, This is the worst thing I've ever experienced'. By focusing on what comes naturally and allowing yourself to experience those negative thoughts, you will have a more realistic view of your situation and may be more able to deal with the difficult experience of the painful task.

We would like you to repeat a statement out loud which focuses on negative feelings, so that the painful experience can be made less intense and more easily endured.

Here is a list of statements which people have found effective in coping with pain." *Present note card to subject.

"Please follow along with me, as I read them out loud." *Read statements from note card.

"This is terrible.

This is never going to get better.

I can't stand it anymore.

This is overwhelming.

I feel like I can't go on.

This is worse than I thought.

I cannot control the pain."

"Please pick one statement that you'd like to use for practice. Now imagine that you are getting ready to place your hand in the ice chest. Practice saying this statement out loud so that I can hear you. Say the statement at a

pace which is comfortable for you." *Repeat with new statement.

"We are just about ready to begin. Please pick one statement that you'd like to use during the task. (Record statement on data sheet). Please use only that statement by repeating it out loud during the task. Say the statement at a pace that is comfortable for you. Continue to use the statement until you remove your hand from the water. Once again, I will also be asking you make pain ratings using the bulb. Each time you hear me say 'rating' squeeze the bulb to indicate your level of discomfort or pain at that moment. Also, remember to indicate when you first feel pain by saying the word 'pain' out loud so that I can hear you. Then keep your hand in the water for as long as you can before removing it."

*Rating of current pain VAS-II.

*After completion of task, administer pain-ratings-II, rating of clinical pain and effectiveness of rationale VAS.

*Do debriefing.

DEBRIEFING SCRIPT

"You have just participated in a study which is examining the role of cognitions or thoughts during a painful experience. This study involved the use of two groups of individuals. Half of the subjects say positive statements during the cold pressor task and the other half

say negative statements during the cold pressor task. You were in the _______ group.

Many studies in the literature now are investigating the role of such statements in pain management. It has been found that what we say to ourselves may influence our experience and report of pain. In particular, the use of catastrophizing has been found to be related to decreased tolerance to pain. Catastrophizing refers to an individual's tendency to overexaggerate the negative aspects of a situation."

PSST group "You were asked to say statements which were the opposite of catastrophizing thoughts. The use of positive thoughts such as those that you were asked to choose from have been found to be an effective means of coping with a painful situation. If you would like any more information regarding the use of such thoughts or about this study, I would be happy to provide that for you now."

NSST group "You were asked to say statements which were similar to catastrophizing thoughts. The use of negative thoughts such as those that you were asked to choose from have not been found to be an effective means of coping with a painful situation. It is believed that it is more effective to use positive thoughts which emphasize coping and control over the situation. So for instance instead of

saying 'This is terrible', you might say 'This isn't as bad as I thought' or instead of saying 'I can't stand this anymore or this is overwhelming', you might say 'I am in control of the pain, I can handle it.' If you would like any more information regarding the use of such thoughts or about this study, I would be happy to provide that for you now."

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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